Seed Production and Quality of Buffelgrass (*Cenchrus ciliaris*) Selections

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SEED PRODUCTION AND QUALITY OF BUFFELGRASS *(CENCHRUS CILIARIS)* SELECTIONS

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Abstract

As seed production and quality are critical considerations in the commercialization of new cultivars, an evaluation programme of promising *Cenchrus ciliaris* (Buffelgrass) accessions placed particular emphasis on these parameters. Accessions identified for registration proved to be superior in both respects, although storage of seed or cleaning of fresh seed reduced the differences in germination between accessions. The refinement of seed cleaning processes should receive greater emphasis by commercial concerns.

Keywords: *Cenchrus ciliaris*, seed dormancy, germination and production.

Introduction

Buffelgrass is well adapted to large areas of South Africa, which are typified by a low and highly variable rainfall. In these areas it is important to identify superior genotypes for the reclamation of degraded rangeland, the stabilization of marginal, or abandoned, croplands and for use in livestock production systems. An evaluation of genotypes from Africa, America, Asia and

Australia, which commenced in 1990 (Rethman et al., 1995), has identified ten promising selections, which were compared with Molopo and T-4464 cultivars from South Africa and United States of America respectively. An important criterion for final selection was the quantity and quality of seed produced. This parameter is of critical importance in the commercialization of new cultivars

Material and Methods

The investigation was conducted on the Hatfield Experimental Farm of the University of Pretoria, located at an altitude of 1372 m.a.s.l. at 28^{o} 15'E and 25^{o} 45'S. The site receives a mean annual rainfall of 650mm, which is concentrated in the period October-April (the summer growing season). While summers are warm (mean maximum in the peak summer months (November-February) is 28^{o}C), the winters are mild. Although the mean minimum in the coldest months is 4^{o}C, occassional severe frosts (< -4^{o}C) are experienced. Buffelgrass is well adapted to the local soil, which was described by McVicar et al. (1977) as a sandy clay Hutton, characterized by excellent drainage, a pH of 6.7 and medium to high P, K, Ca and Mg status.

After establishing vegetative material in a randomized block design with 12 treatments and three replications in December 1995, the experimental area was mown in February 1996 and topdressed with 50kg Nha^{-1}. Seed produced in the late summer period of the 1995/96 season was harvested by hand and the germination percentage assessed. Germination trials were conducted in a growth chamber at 30^{o}C/20^{o}C, with 12 hours of light (ISTA, 1996), with a comparison of 1995/96 (fresh) seed and 1991/92 (stored) seed, as well as a comparison between shelled and unshelled seed. In the early summer of the 1996/97 growing season, after a spring application of 75kg Nha^{-1}, seed produced by the different selections was again harvested and the germination of

this fresh seed (one month after harvest) was compared with that of seed produced the previous summer (eight months after harvest).

Results and Discussion

Seed production: Although it would have been ideal to has repeated this trial over time, considering the seasonal phenology of the different selections and cultivars, these results give a good idea of the wide range in seed production potential. Although the three cultivars registered in South Africa, together with the Worcester accession, also from South Africa, did particularly well under local conditions, it is evident that there is considerable genotypic variation. There is, therefore, the possibility that other accessions or cultivars might come to the fore under different climatic conditions.

Germination: It is very evident (table 2) that storage of seed, as also reported by Hacker and Radcliff (1989), improved germination. The effect of removing the husks surrounding the seed (Hacker and Radcliff, 1989; Venter and Rethman, 1992) was even more dramatic. While older seed had a markedly better germination than fresh seed in both 1996 (67% *vs* 39%) and 1997 (31% *vs* 4%), cleaning the seed improved the germination dramatically, with an average of 90% being registered with three month old seed. From the point of view of comparing accessions and cultivars it is also evident that there is a wide range between selections. This is particularly true with relatively fresh seed, where the new cultivars (Kalahari and Mopani) were consistently above average, but was smaller in older seed and virtually disappeared when the seed was cleaned.

It is clear from these results that the new cultivars (Kalahari and Mopani) are superior types with respect to both production and germination. The latter, however, although varying markedly between cultivars and accessions, is particularly sensitive to storage (the longer the

better) and seed cleaning. It is strongly recommended that the latter practice be refined and commercialized in countries where it is not currently used.

References

Hacker, J.B. and Radcliff D. (1989). Seed dormancy and factors controlling dormancy breakdown in buffelgrass accessions from contrasting provenances. J. Appl. Ecol**. 26**: 201-212.

ISTA-International Seed Testing Association. (1996). International rules for seed testing. Seed Sci. & Tech. **24**: 299-355.

MacVicar, C.N., Loxton R.F., Lamprechts J.J.N., Le Roux J., De Villiers J.M., Verster E., Merryweather F.R., Van Rooyen J.H. and Von M. Harmse J.H. (1977). Soil classification: A binomial system for South Africa. Dept. Agric. Tech. Serv., Pretoria, South Africa

Rethman, N.F.G., Meissner H.H. and Cox J.R. (1995). Evaluation of *Cenchrus ciliaris* ecotypes in terms of productivity and quality. Proc. Vth. Internat. Rangel. Congress. Salt Lake City, Utah, USA.

Venter, P.S. and Rethman N.F.G. (1992). Germination of fresh seed of thirty *Cenchrus ciliaris* ecotypes as influenced by seed treatment. J. Grassl. Soc. South. Afr. **9**: 181-182.

Table 1 - Results of the auxin test and degree of parthenogenesis in the parthenogenetic F_1 plants tested.

Plant No.	Seeds examined	Sterile seeds %	Seeds with endosperm %	Seeds without endosperm			Degree of parthenogenesis[(2)]
				With embryo[(1)]	Without embryo	%	
2	610	12.5	20.2	4	407	67.4	1.0
6	196	15.3	29.1	3	106	55.6	2.8
7	113	8.0	18.6	76	7	73.5	91.6
9	394	60.9	27.9	3	41	11.2	6.8
14	134	31.3	36.6	18	25	32.1	41.9
15	335	8.7	40.9	128	41	50.4	75.7
17	161	16.1	21.7	1	99	62.1	1.0
26	403	22.3	21.8	191	34	55.8	84.9
29	466	35.0	16.7	37	188	48.3	16.4
31	115	23.5	34.8	1	47	41.7	2.1
32	93	21.5	15.1	4	55	63.4	6.8
33	215	2.3	22.8	23	138	74.9	14.3
34	56	32.1	1.8	1	36	66.1	2.7
36	261	18.0	1.9	3	206	80.1	1.4
37	110	11.8	22.7	2	70	65.5	2.8

(1) Formed by parthenogenetic egg cells following the auxin test
(2) Ratio of the number of seeds with embryo, without endosperm, and the total number of seeds without endosperm

Table 2 - Results of the analyses of variance for S and A markers and LS means of the marker classes.

Marker[1]	DF	Type III SS	F	Pr > F	R^2 (%)[2]	Degree of parthenogenesis LS Means[3]	
						Marker present	Marker absent
CCA/AAT/12-S	1	0.537	40.16	0.0001	22.4	0.11	0.48
CCA/AAT/2-S	1	0.153	11.45	0.007	6.4	0.17	0.39
AS1/AAC/6-S	1	0.232	17.32	0.002	9.7	0.16	0.41
AS1/ACT/16-S	1	0.125	9.33	0.012	5.2	0.37	0.18
Error	10	0.134	-	-	-	-	-
CAA/AAC/11-A	1	1.153	12.09	0.004	48.2	0.48	0.04
Error	13	1.240	-	-	-	-	-

[1] -S: markers from the sexual (maternal) parent; -A: marker from the apomictic (paternal) parent
[2] Coefficients of determination were calculated as the ratios of marker to total sums of squares
[3] Back-transformed mean values